Uniform Survey Procedure Approved By
The Lake States Forest Insect Survey Committee - 1956

JACK-PINE BUDWORM SURVEYS

PURPOSE:

The jack-pine budworm, Choristoneura pinus Freeman, is a serious problem in natural jack pine stands throughout the Lake States. Since its identification in 1923, it has caused the mortality of substantial volumes of merchantable jack pine and vast numbers of sapling and reproduction jack, red, and white pine growing in the understory. Outbreaks of this insect occur periodically at intervals of from 6 to 8 years and last for 2 to 4 years.

During the recent (1949-1952) budworm outbreak in the Lower Peninsula of Michigan, survey techniques were developed by the U. S. Bureau of Entomology and Plant Quarantine in cooperation with the Forest Service and the Michigan Conservation Department, for evaluating the infestation. Inasmuch as the insect was widely distributed and present in varying degrees of intensity throughout the jack-pine type, surveys to detect its presence or absence were not deemed necessary. Procedures to appraise the seriousness of infestations and to estimate loss of the forest resource were designed and field tested. The methods and procedures found satisfactory are presented here.

INSTRUCTIONS:

Appraisal Survey

Appraisals of the seriousness of known jack-pine budworm infestations in Michigan and Wisconsin are conducted after defoliation is completed and before the damage (clipped) foliage has fallen from the trees. The following procedure is designed to enable the rapid evaluation of an infestation over a rather large area in a minimum of time. No attempt is made to collect information relative to stand composition or site quality.

A series of temporary roadside observation stations each located in jack-pine type at intervals of approximately 1 mile along the major transportation routes throughout the infestation area are established. The severity of budworm defoliation of the general stand is estimated at or beyond 200 feet from the road right-of-way. Criteria of defoliation employed are as follows:

1. None - No budworm defoliation evident on trees or reproduction. Crowns of canopy green. No budworm cast pupal skins on trees or reproduction.

2. Light - No budworm defoliation evident, or barely evident on trees. Crowns of canopy green.. Budworm defoliation evident on understory reproduction. Leaders and laterals of understory trees not webbed together. Budworm cast pupal skins present on trees or reproduction.

3. Medium - Budworm defoliation evident on trees. Crowns of canopy predominantly green but with brownish to reddish background. Defoliation of understory reproduction evident. Leaders and laterals of understory trees webbed together. Cast pupal skins present on trees and understory reproduction.

4. Heavy - Budworm defoliation evident on trees to complete defoliation. Crowns of canopy predominantly reddish brown. Budworm defoliation of understory reproduction severe to complete. Leaders and laterals of understory trees webbed together. Cast pupal skins present on trees and understory reproduction.

The survey form below will be used to record the necessary data at each observation station.

The stations will be numbered consecutively and the mileage or distance from a landmark noted. Each station will be located by township, range, and section, and, if possible, by quarter section.

The degree of overstory and understory defoliation should be estimated and the presence of lateral-terminal webbing and cast pupal skins noted. The severity of general infestation should also be noted. Any other observations on stand conditions, etc., can be made in the space provided for remarks at the botton of the form.

A narrative report, summarizing the findings of the survey, will include the methods employed, a map indicating categories of defoliation severity by acreages, and general conclusions and recommendations.

JACK-PINE BUDWORM - DEFOLIATION APPRAISAL SURVEY

Station number	Mileage from landmark	Location				Overstory defoliation				Understory defoliation					Cast pupal skins		Severity of infestation			
		T	R	S	Q	N	L	M	H	N	L	M	H	L-T web-bing	Under-story	Over-story	N	L	M	H

Remarks:

Aerial Surveys

An evaluation of jack-pine budworm infestations from the air is conducted by examining infestations along predetermined flight lines established at uniform intervals of from 1 to 12 miles. Random or meandering flights along the boundary of known infestations also are used in aerial surveys. The operation recorder probably would be of material help for use in recording infestations in this region from the air.

In the conduct of the aerial survey for the jack-pine budworm the following steps are taken:

1. Areas of known infestation intensity are located on the ground and flown over to acquaint observers with known intensity of budworm defoliation.

2. Criteria of abundance employed.

   a. None-light - No defoliation evident. Crowns normal green.

b. Medium - Defoliation evident. Crowns predominantly green with brownish background.

c. Heavy - Defoliation evident. Crowns predominantly reddish brown.

3. Airplane. A single-engine, high-wing airplane, such as the Cessna 170-B or Cessna 180, gives very satisfactory performance, with ample room for two observers. The flight lines should be 1 - to 12 - mile grids, along north-south or east-west lines, and the altitude should be 500 to 1,000 feet.

4. Mapping. County, Highway, Cover Type, or Aerial Navigation maps can be used--a scale of 1/2 inch or 1 inch per mile is preferable, if available. The general location of defoliation can be sketched in by foregoing criteria.

5. Report. This should be incorporated with a ground survey.

Timber Drain Survey

An appraisal of the loss of timber caused by budworm feeding in Michigan and Wisconsin is conducted after defoliation is completed, generally in mid-August, or early September. The following general procedure is followed:

1. The area of infestation is determined from reconnaissance survey maps and the area of each category of severity of defoliation is computed.

2. The number of evaluation plots required is determined from the Intensity of Sampling statement prepared for the Lake States Forest Insect Survey Committee (see CEIR 6(28):675). This number is based on the standard of accuracy required, the density and uniformity of the stand, the value of the stand, and the acreage to be sampled.

3. Plot location and procedure.

   a. Two or three men will comprise a crew. Note the mileage from a definite landmark: river, crossroad, or estimated distance if cruising or walking. If the survey is conducted by road the plots should be approximately 5 chains from the road right-of-way.

   b. The plots should be 1/5 acre, with a convenient tree as the center. Plot examination should be by sectors, using two plastic ropes, each 52.7 feet long. Tree diameter will be taken by diameter tape or cruiser's stick. The number of logs can be determined by cruiser's stick or by estimation. Reproduction can be determined by actual tally.

4. Tree tally. Using the Cumulative Tree Tally Form 99-R9 (Rev. 6/17/47) record trees by species and diameter class--2-inch saplings, 4-inch saplings, 6-inch and over merchantable poles, and reproduction. A record of the health class should also be made by (a) living, (b) dead - budworm killed, and (c) dead - (suppressed) budworm killed).

5. A summary report should be prepared to show methods employed, area surveyed, summary of losses, general conclusions, and recommendations and predictions.

D. M. Benjamin, University of Wisconsin

Form 99 R-9

CUMULATIVE 1/5 ACRE TALLY SHEET

DBH: 2" / 4"

ESTIMATOR _____ DATE _____

COURSE _____ PLOT _____ SEC. _____ T. _____ R. _____

MAP TYPE

PLOT TYPE

DBH | SPEC. & LEGEND | NON-MERCH.

NUMBER OF 8-FOOT BOLTS (4" OR LARGER) PER TREE

1	2	3	4
1 2 3 4 5 6 6 7 8 9 / 10 11 12 13 14 15 16 / 17 18 18 19 20 21 / 22 23 24 25 26 27	1 3 4 6 7 9 10 12 13 15 16 / 18 19 21 22 24 25 27 28 / 30 31 33 34 36 37 39 40 / 42 43 45 46 48 49 51 52	2 4 6 9 11 13 15 17 19 22 / 24 26 28 30 32 35 37 39 41 / 43 45 48 50 52 54 56 58 60 / 63 65 67 69 71 73 76 78 80	3 6 9 12 14 17 / 20 23 26 29 32 / 35 37 40 43 46 49 / 52 55 58 60 63 66

MORTALITY / ACRE

NO. TREES 2"	NO. TREES 4"	VOL BY SPECIES SPEC.	VOL BY SPECIES CDS.	VOL BY SPECIES BD. FT.

TOTALS PER ACRE

6 CORDS PER ACRE

1	2	3	4
1 2 3 4 5 6 6 7 8 9 / 10 11 12 13 14 15 16 / 17 18 18 19 20 21 / 22 23 24 25 26 27	1 3 4 6 7 9 10 12 13 15 / 16 18 19 21 22 24 25 27 / 30 31 33 34 36 37 39 / 42 43 45 46 48 49 51 52	2 4 6 9 11 13 15 17 19 22 / 24 26 28 30 32 35 37 39 41 / 43 45 48 50 52 54 56 58 60 / 63 65 67 69 71 73 76 78 80	3 6 9 12 14 17 20 / 23 26 29 32 35 37 40 / 43 46 49 52 55 58 60 / 63 66 69 72 74 77 79 82 84
1 2 3 4 5 6 6 7 / 8 9 10 11 12 13 / 16 18 19 21 22 24 25 27	1 3 4 6 7 9 10 12 13 15 / 16 18 19 21 22 24 25 27	2 4 6 9 11 13 15 17 19 / 22 24 26 28 30 32 35 37 / 40 42 45 47 50 52 55 57	3 6 9 12 14 17 20 23 / 26 29 32 35 37 40 43 46 / 49 52 55 58 61 64 67 70
1 2 3 4 5 6 6 / 7 8 9 10 11 12 13 / 16 18 19 21 22 24 25 27	1 3 4 6 7 9 10 12 13 15 / 16 18 19 21 22 24 25 27	2 4 6 9 11 13 15 17 19 / 22 24 26 28 30 32 35 37 / 40 42 45 47 50 52 55 57	3 6 9 12 14 17 20 23 26 / 29 32 35 37 40 43 46 49 / 52 55 58 61 64 67 70 73

5	6
6 12 17 / 23 29 35 / 41 46 52 58 / 63 68 73 78	7 14 / 21 28 / 34 41 48 / 55 62 69

AVERAGE PERCENT DEFECT

POLES

8 VOLUME IN TENTHS OF CORDS PER ACRE

1	2	3	4
2 3 5 6 8 10 11 13 / 14 16 18 / 19 21 22 24 / 26 27 29 30	2 5 7 10 12 15 17 20 22 / 25 27 30 32 35 37 40 / 42 45 47 50 52 55 57 / 60 62 64 67 69 72 74	3 7 10 14 17 21 24 28 / 31 35 38 42 45 49 52 56 / 60 63 66 70 73 77 80 84 / 87 91 94 98 101 105 108	5 9 14 18 23 28 32 37 41 / 46 51 55 60 65 69 74 78 / 83 88 92 97 101 106 111 / 115 120 124 129 134 138
2 3 5 6 8 10 / 11 13 14 16 / 18 19 21 22	2 5 7 10 12 15 17 20 / 22 25 27 30 32 35 37 / 40 42 45 47 50 52 55	3 7 10 14 17 21 24 28 / 31 35 38 42 45 49 52 56 / 60 63 66 70 73 77 80 84	5 9 14 18 23 28 32 37 41 / 46 51 55 60 65 69 74 78 / 83 88 92 97 101 106 111
2 3 5 6 8 / 10 11 13 / 22 25 27 30 32 35 37	2 5 7 10 12 15 17 20 / 22 25 27 30 32 35 37	3 7 10 14 17 21 24 28 / 31 35 38 42 45 49 52 56	5 9 14 18 23 28 32 37 / 41 46 51 55 60 65 69 74
2 3 5 6 8 / 10 11 13 / 22 25 27 30 32 35 37	2 5 7 10 12 15 17 20 / 22 25 27 30 32 35 37	3 7 10 14 17 21 24 28 / 31 35 38 42 45 49 52 56	5 9 14 18 23 28 32 37 / 41 46 51 55 60 65 69 74

5	6
6 12 17 23 / 29 35 41 / 46 52 58 / 63 68 73 78	7 14 21 / 28 34 41 48 / 55 62 69
6 12 17 23 / 29 35 41 / 46 52 58 / 63 68 73 78	7 14 21 / 28 34 41 48 / 55 62 69
6 12 17 23 / 29 35 41 / 46 52 58 / 63 68 73 78	7 14 21 / 28 34 41 48 / 55 62 69

AVERAGE PERCENT DEFECT

POLES

10 VOLUME IN HUNDREDS OF BOARD FEET (SCRIBNER) PER ACRE

NUMBER OF 16-FOOT LOGS (8" OR LARGER) PER TREE

1/2	1	1 1/2	2
1 1 2 3 3 4 5 / 6 6 7 8 8 9 10 / 11 11 12 13 13 / 14 15 15 16 17	2 3 4 6 7 9 10 12 13 / 15 16 18 19 21 22 24 / 25 27 28 30 31 33 34 / 36 37 39 40 42 43 45	2 4 6 8 10 12 14 16 / 18 20 22 24 26 28 30 / 32 34 36 38 40 42 44 / 46 48 50 52 54 56 58	
1 2 3 3 4 5 / 6 6 7 8 8 9 10 / 11 11 12 13 13 / 14 15 15 16 17	2 3 4 6 7 9 10 12 13 / 15 16 18 19 21 22 24 / 25 27 28 30 31 33 34 / 36 37 39 40 42 43 45	2 4 6 8 10 12 14 16 / 18 20 22 24 26 28 30 / 32 34 36 38 40 42 44 / 46 48 50 52 54 56 58	
1 2 3 3 4 5 / 6 6 7 8 8 9 / 11 11 12 13 13 / 14 15 15 16 17	2 3 4 6 7 9 10 12 / 13 15 16 18 19 21 22 / 25 27 28 30 31 33 34 / 36 37 39 40 42 43 45	2 4 6 8 10 12 14 16 / 18 20 22 24 26 28 30 / 32 34 36 38 40 42 44 / 46 48 50 52 54 56 58	
1 2 3 3 4 5 / 6 6 7 8 8 9 / 11 11 12 13 13 / 14 15 15 16 17	2 3 4 6 7 9 10 12 / 13 15 16 18 19 21 22 / 25 27 28 30 31 33 34 / 36 37 39 40 42 43 45	2 4 6 8 10 12 14 16 / 18 20 22 24 26 28 30 / 32 34 36 38 40 42 44 / 46 48 50 52 54 56 58	

RECOMMENDED CUT (NET) / ACRE

TYPE OF CUT	PERIOD	SPEC.	CORD	M BD. FT.
IMPROVEMENT				
SALVAGE				
ROTATION				
2 1/2 TOTAL				

TOT. CORDS

12 PER ACRE

1	2	3	4
1 3 4 6 7 8 / 10 11 13 14 / 15 17 18 20 / 21 22 24 25	2 5 7 10 12 14 17 19 / 22 24 29 29 31 34 / 38 41 43 46 48 50 53 / 55 58 60 62 65 67 70	3 7 10 13 16 20 23 / 26 30 33 36 40 43 46 / 50 53 56 59 63 66 69 / 73 76 79 82 86 89 92	4 8 12 16 20 23 / 27 31 35 39 43 47 / 51 55 58 62 66 70 / 74 78 82 86 90 94
1 3 4 6 7 8 / 10 11 13 14 / 15 17 18 20	2 5 7 10 12 14 17 19 / 22 24 29 29 31 34 / 36 38 41 43 46 48	3 7 10 13 16 20 23 / 26 30 33 36 40 43 / 46 50 53 56 59 63	4 8 12 16 20 23 / 27 31 35 39 43 47 / 51 55 58 62 66 70
1 3 4 6 7 8 / 10 11 13 14	2 5 7 10 12 14 17 19 / 22 24 29 29 31 34	3 7 10 13 16 20 23 / 26 30 33 36 40 43	4 8 12 16 20 23 / 27 31 35 39 43 47
1 3 4 6 7 8 / 10 11 13 14	2 5 7 10 12 14 17 19 / 22 24 29 29 31 34	3 7 10 13 16 20 23 / 26 30 33 36 40 43	4 8 12 16 20 23 / 27 31 35 39 43 47

5	10	15	19
5 10 15 19 / 24 29 34 39 / 44 48 53 58 / 63 68 73 78			
5 10 15 19 / 24 29 34 39 / 44 48 53 58 / 63 68 73 78			
5 10 15 19 / 24 29 34 39 / 44 48 53 58 / 63 68 73 78			
5 10 15 19 / 24 29 34 39 / 44 48 53 58 / 63 68 73 78			

TOTAL NET VOLUME

SPECIES	CORDS	M. BD. FT.

14 PER ACRE

1	2	3	4
2 4 6 8 10 12 / 14 16 18 20 / 22 24 26 28	4 7 10 14 18 21 24 / 28 32 35 38 42 46 / 49 52 56 60 63 66	5 10 14 19 24 29 34 / 38 43 48 53 58 62 / 67 72 77 82 86 91	6 12 17 23 29 34 / 39 43 48 53 58 62 / 67 72 77 82 85 91
2 4 6 8 10 12 / 14 16 18 20	4 7 10 14 18 21 24 / 28 32 35 38 42 46	5 10 14 19 24 29 34 / 38 43 48 53 58 62	6 12 17 23 29 35 / 41 46 52 58 64 70 / 75 81 87 93 99
2 4 6 8 10 / 12 14 16 18	4 7 10 14 18 21 24 / 28 32 35 38 42 46	5 10 14 19 24 29 34 / 38 43 48 53 58 62	6 12 17 23 29 35 / 41 46 52 58 64 70
2 4 6 8 10	4 7 10 14 18 21 24	5 10 14 19 24 29 34	6 12 17 23 29 35

7	14	21	28
7 14 21 28 / 35 42 49 56 / 63 70 77 84 / 92 99 106			
7 14 21 28 / 35 42 49 56 / 63 70 77 84 / 92 99 106			
7 14 21 28 / 35 42 49 56 / 63 70 77 84 / 92 99 106			
7 14 21 28 / 35 42 49 56 / 63 70 77 84 / 92 99 106			

8	16	25	33	9	19
8 16 25 33 / 41 50 58 66 / 74 82 91 99 / 107 115 123 131					
8 16 25 33 / 41 50 58 66 / 74 82 91 99 / 107 115 123 131					
8 16 25 33 / 41 50 58 66 / 74 82 91 99 / 107 115 123 131					
8 16 25 33 / 41 50 58 66 / 74 82 91 99 / 107 115 123 131					

3	3 1/2
9 19 / 28 38 / 47 57	
9 19 / 28 38 / 47 57	
9 19 / 28 38 / 47 57	
9 19 / 28 38 / 47 57	

AVERAGE PERCENT DEFECT

SAWTIMBER

16 PER ACRE

1	2	3	4
3 5 8 11 14 / 16 19 22 24 / 27 30 33 35	5 9 14 19 23 28 / 33 37 42 46 51 56 / 60 65 70 74 79 84 / 88 93 98 102 107 112	6 13 19 26 32 39 / 45 52 58 64 71 77 / 84 90 97 103 110 116 / 123 129 135 142 148 155	8 15 24 32 40 47 / 55 63 71 79 87 95 / 103 111 119 127 135 143 / 151 159 167 175 183 191